

MP2-10

Long axis dysfunction and stiff arteries in children with severe acute malnutrition in Kenya.

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Background. Annually, 2.1 million children die world wide as a consequence of severe acute malnutrition (SAM). There is conflicting evidence on cardiac function in SAM, which has influenced treatment guidelines. We wished to establish whether children with SAM have impaired ventricular function.

Methods. In the CArdiac Physiology in MALnutrition (CAPMAL) Study we recruited children with SAM (marasmus or kwashiorkor), and age and gender matched, equally sick non-malnourished controls who presented to a rural Kenyan hospital between March and November 2011. Echocardiograms, lactate and N-Terminal-proBNP (NT-proBNP) were recorded at days 0, 7 and 28.

Results. 88 SAM cases and 22 controls had similar baseline characteristics apart from anthropometry (weight for height z-score -3.2 for cases vs -1.1 for controls) and HIV status (22.7% vs 0.0%) ($p < 0.05$).

On admission, SAM children had reduced long axis function compared with controls in the right (TAPSE 13.9 vs 17.0mm; $p < 0.0001$) and left ventricle (MAPSE 8.4 vs 10.5mm; $p < 0.0001$), reduced systolic myocardial velocity (5.6 vs 7.9 cm/s, $p < 0.0001$) and early diastolic velocity (10.7 vs 13.7 cm/s, $p = 0.003$). Systemic vascular resistance index (SVRI) was increased in SAM at all reviews (day 0: 1862 vs 1015, day 7: 1538 vs 966 and day 28: 1476 vs 973, all $p < 0.005$). Both TAPSE and MAPSE were negatively correlated with SVRI (Spearman's $\rho = -0.5863$ and -0.5803 respectively, $p < 0.0001$). We found no difference on admission in fractional shortening (36.4 vs 37.8%), Tei Index (0.39 vs 0.34), E/A ratio (1.24 vs 1.16), cardiac index (CI) or left ventricular mass (LVm) (all $p > 0.05$). Similar differences were seen when the analysis was confined to HIV-negative children, apart from CI and LVm which were significantly lower in cases. No difference in lactate and NT-proBNP was observed at any time point.

Conclusions. This is the first detailed echocardiographic study of children with SAM, and the first to report a reduction in long axis function in SAM. This is associated with increased systemic vascular resistance and might help to explain why children fare badly on attempted re-feeding. It might also help explain why systemic hypertension is seen in adults with a history of childhood malnutrition.